Image Acquisition Toolbox 1

Acquire images and video from industry-standard hardware

The Image Acquisition Toolbox extends the MATLAB® technical computing environment to include functions for acquiring video and images from PC-compatible frame-grabber cards and video devices. The toolbox lets you connect to and configure your hardware, preview your video, and stream images directly into MATLAB for analysis and visualization.

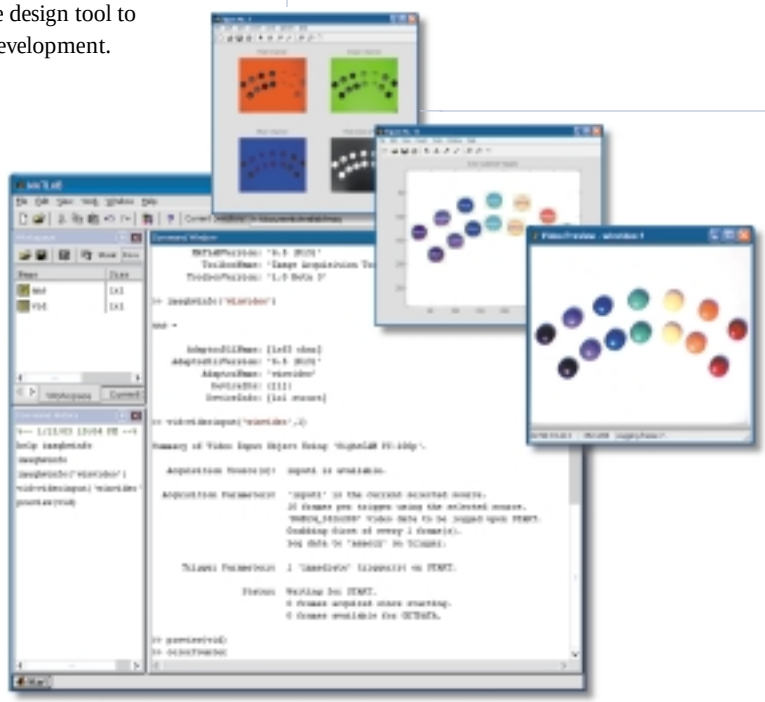
Together, MATLAB and the Image Acquisition Toolbox provide direct access to hardware video devices, as well as advanced and proven analysis routines for your scientific imaging applications.

Working with the Image Acquisition Toolbox

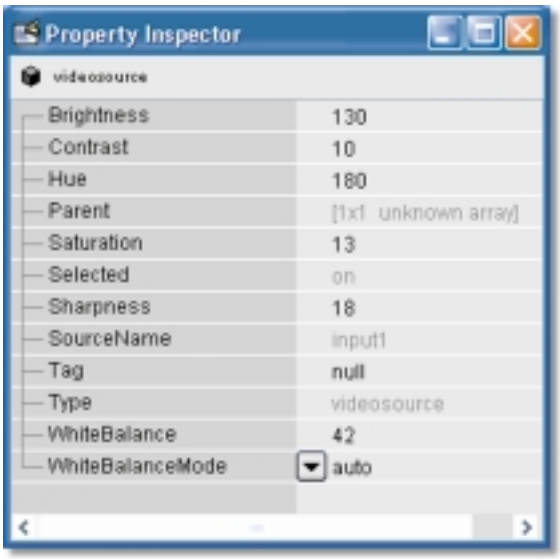
You can execute Image Acquisition Toolbox functions directly from the MATLAB command line, or you can incorporate the toolbox functions into your own MATLAB applications. MATLAB provides an editor/debugger, a performance profiler, and a graphical user interface design tool to accelerate your application development.

KEY FEATURES

- Provides access to live image and video streams directly from MATLAB
- Interfaces with industry-standard analog and digital frame grabbers from Matrox and Data Translation
- Interfaces with Windows-compatible video-capture devices, such as USB and FireWire (IEEE-1394) scientific video cameras, as well as Web cameras, video capture boards, and DV camcorders
- Provides live video previewing
- Enables single-frame and continuous acquisitions featuring automatic buffer management
- Supports nonstandard and standard video formats, including CCIR, NTSC, PAL, RGB, RS170, SECAM, and S-Video
- Enables simultaneous image acquisition and image processing
- Provides access to supported hardware features, such as gain, brightness, contrast, and sync selection



Sample application using the Image Acquisition Toolbox to stream images into MATLAB, process the images to isolate objects, and categorize the objects based on color.



The property inspector tool enables you to easily view and modify your video device settings, such as brightness, contrast, and saturation.

The Image Acquisition Toolbox helps you connect to and configure your hardware, preview the acquisition, and acquire, log, and process the image data. The toolbox also includes advanced image acquisition features, such as triggers and callbacks.

Connecting to Hardware

The Image Acquisition Toolbox detects compatible image-acquisition devices automatically. You can easily scan for detected devices from the MATLAB command line.

Accessing devices requires only one line of code. You simply call a toolbox function to create an object directly associated with your device. Objects are special data types that encapsulate a device's functionality, providing an intuitive interface to your hardware.

Configuring Hardware

You configure your hardware by modifying the properties of the object associated with it. You can easily browse and configure properties by using either simple text commands or the graphical property inspector tool.

The toolbox provides two sets of properties: base properties and device-specific properties. Both enable you to design your code to work with devices from multiple vendors while still taking advantage of device-specific features.

Base properties expose features that are common to all supported hardware, and include properties such as:

- Video format
- Resolution
- Region of interest
- Frame grab interval

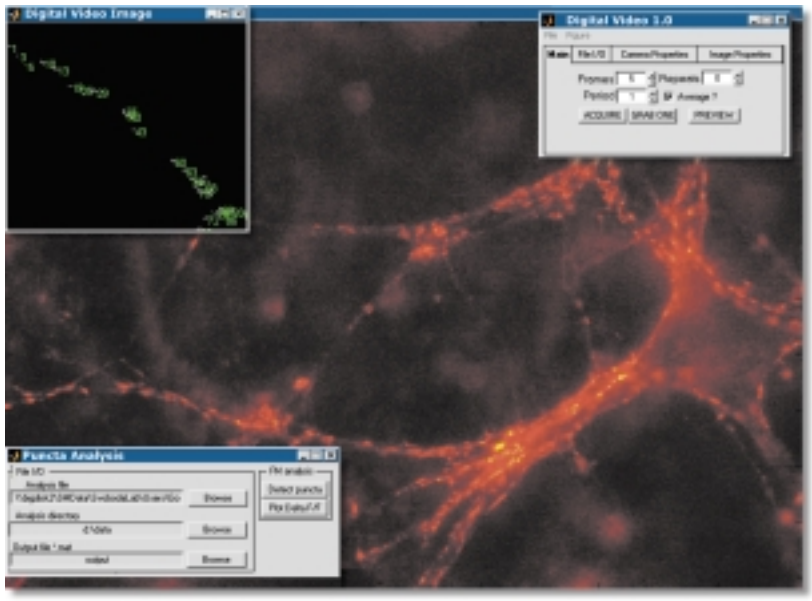
Device-specific properties expose features specific to certain hardware models, and may include properties such as:

- Hue, saturation, and brightness
- Frame rate
- Contrast
- Video sync
- White and black reference levels

Previewing the Acquisition

The video preview window helps you quickly verify and optimize your acquisition parameters. The preview window instantly reflects any adjustments you make to acquisition properties.

The Image Acquisition Toolbox supports industry-standard devices for capturing images and video, which can then be analyzed in MATLAB.



MATLAB application* using the Image Acquisition Toolbox with a camera to acquire images of central synapses and monitor synaptic transmission over time. Graphical user interfaces (upper right and lower left) enable researchers to modify acquisition and processing parameters.

*Image courtesy of Pologruto, T.A., Tervo, D. G., & Svoboda, K. HHMI/CSHL.

Acquiring Image Data

With its multithreaded architecture, the Image Acquisition Toolbox can continuously acquire image data in the background while you simultaneously process acquired image data by calling MATLAB functions and scripts.

The toolbox automatically buffers acquired data into memory, handles memory and buffer management, and supports any color space provided by the image acquisition device, including the RGB, YUV, and monochrome color spaces.

Logging Image Data

You can log data to disk, memory, or both simultaneously. You can also log each image frame or log frames at specified intervals. Data can be logged to disk as compressed or uncompressed AVI streams.

You can extract single images from a video stream and store them to disk in standard formats, including BMP, JPEG, and TIFF.

Processing Image Data

The Image Acquisition Toolbox represents image data in the MATLAB workspace as multidimensional arrays, enabling you to process and visualize your data using standard MATLAB functions. The array data can be provided in any numerical data type supported by MATLAB, including UINT8, UINT16, UINT32, and double precision.

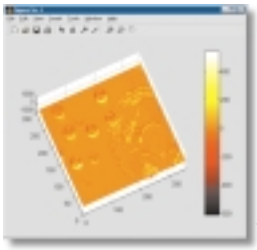
The data returned by the Image Acquisition Toolbox is fully compatible with the advanced image processing functions and tools in the Image Processing Toolbox.

Advanced Acquisition Features

The Image Acquisition Toolbox supports three trigger types: immediate, manual, and hardware. Hardware triggers, which are device-specific, let you synchronize your acquisition to an external signal.

For advanced sequencing of your acquisition application, the Image Acquisition Toolbox enables you to create callback functions that are automatically executed whenever events occur, such as:

- Acquisition started or stopped
- Trigger occurred
- Set number of frames acquired
- Set amount of time passed
- Error occurred



```
% Create a video input object to interface
% with the Windows video camera with ID 1.
vid = videoinput('winvideo', 1);

% Configure the object to acquire 100
% video frames and open a preview window.
preview(vid);
vid.FramesPerTrigger = 100;

% Acquire the video frames.
start(vid);
data = getdata(vid, 100, 'double');

% Average the frames and apply a Sobel edge
% enhancement filter to the red color band.
ave = mean(data, 4);
filtered = filter2(fspecial('sobel'), ave(:, :, 1));
surf(filtered);
shading('interp');colormap('hot');colorbar;
```

A script illustrating the three steps of a typical MATLAB image acquisition session: creation, configuration, and acquisition. A few lines of code let you acquire 100 video frames from a scientific camera, process the averaged frames with an edge-enhancement filter, and visualize the results as a 3-D surface.

Required Products

MATLAB

Related Products

Data Acquisition Toolbox. Acquire and send out data from plug-in data acquisition boards.

Image Processing Toolbox. Perform image processing, analysis, and algorithm development.

Instrument Control Toolbox. Control and communicate with test and measurement instruments.

Signal Processing Toolbox. Perform signal processing, analysis, and algorithm development.

Supported Hardware

The Image Acquisition Toolbox currently supports analog and digital frame grabbers from the following vendors:

- Matrox
- Data Translation

The toolbox also supports video capture devices that provide WDM (Windows Driver Model) or VFW (Video for Windows) drivers, including:

- Web cameras
- USB and FireWire (IEEE-1394) scientific video cameras
- Video capture boards
- DV camcorders

For a complete list of supported hardware, visit *www.mathworks.com/products/imaq*

Platform and System Requirements

The Image Acquisition Toolbox is available for Windows 98/ME/NT/2000/XP. For additional information and system requirements, visit *www.mathworks.com/products/imaq* ■

For demos, application examples, tutorials, user stories, and pricing:

- Visit **www.mathworks.com**
- Contact The MathWorks directly

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